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## (54) A process for preparing a chewable pet food

(57) A process for preparing an extrudable product suitable for forming into a chewable pet food and comprising between 56% to 80% dry wheat gluten mix, between 9% to 28% liquid plasticiser mix and between 8% to 18% moisture by weight of the product is disclosed. The process comprises mixing the dry wheat gluten mix with water in an extruder, to form a moist wheat gluten mix, and mixing the moist wheat gluten mix with a liquid plasticiser mix and extruding at a temperature of less than 70°C to form the extrudable product. The invention also relates to the extrudable product and to the chewable pet food formed therefrom by means of either further extrusion or injection moulding.

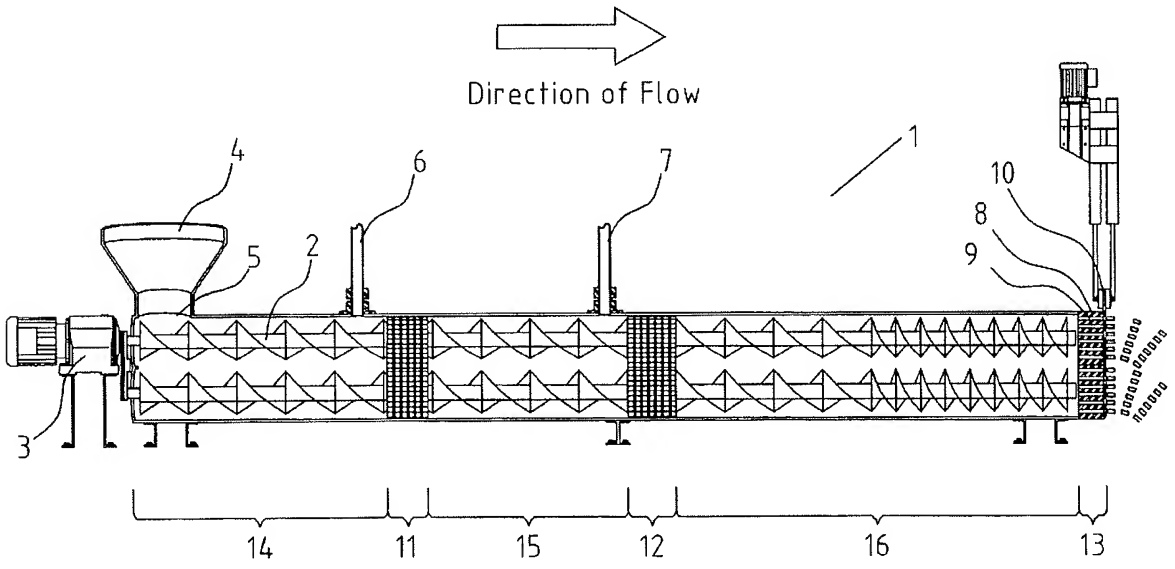


Fig. 1

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## Description

### Introduction

**[0001]** The present invention relates to a process for preparing an extrudable product, suitable for forming into a chewable pet food and comprising between 56% to 80% dry wheat gluten mix, between 9% to 28% liquid plasticiser mix and between 8% to 18% moisture by weight of the product. The invention further relates to the extrudable product prepared by that process. The invention also relates to a process for preparing a chewable pet food from the extrudable product and additionally relates to the chewable pet food.

**[0002]** It is well known to produce products from wheat gluten and plasticisers. Wheat gluten is used in certain products as it imparts elasticity to the product. However, there are difficulties in processing wheat gluten and in particular controlling the processing flowability. US Patent No. 5,665,152 discloses a method of forming a biodegradable article from a formulation comprising, among other components, a grain protein such as wheat gluten, starch, a plasticiser and a reducing agent. The formulation is pelleted by extrusion processing at temperatures of less than 80°C to avoid protein denaturation. A reducing agent is added to improve the flowability during processing. A disadvantage of adding a reducing agent, is that most reducing agents are not compatible with animal feed regulations, and therefore the resultant products would be unsuitable for use as an animal chew.

**[0003]** PCT Publication No. WO 00/13521 discloses a protein-based thermoplastic composition comprising, among other components, a protein such as soy protein or wheat gluten and an edible plasticiser. The composition can be formed into a chewable pet toy or artificial dog bone by injection moulding, pressure moulding, transfer moulding or extrusion moulding. In this case water is added to improve the processing flowability. During processing the water content of the composition is increased to 35% by weight of the composition. Some of this water is removed downstream of the process by drying the pellets. The disadvantage however of adding water to improve the processing flowability is that this water must be removed downstream, necessitating the requirement of a drying step to remove the excess water which is both expensive and time consuming. Furthermore at a high moisture content the wheat gluten adopts a chewing gum like consistency, becomes sticky and is extremely difficult to handle during processing. Additionally, the high percentage of water added has a disadvantageous effect on the resultant product in that as water evaporates from the product during storage the surfaces of the product crack.

**[0004]** In the process disclosed in PCT Publication No. WO 00/13521, the ingredients are all blended and mixed together uniformly, at the same time. This is disadvantageous in that the moisture uptake of the protein and thus the overall moisture content is difficult to control thus resulting in the need for an additional amount of water to be added than what is actually required to provide the minimum moisture content necessary to hydrate the protein. Additionally, extrusion is carried out at temperatures in the region of between 95°C and 110°C. The disadvantage of using temperatures in this region is that protein denaturation occurs. As the protein denatures, its molecular structure and thus properties change. This results in a product of reduced nutritional value. Furthermore during denaturation of the protein the composition containing the protein hardens and forms a shape in the extruder. Further shaping of the composition downstream is therefore difficult.

**[0005]** Thus, there is a need for a process for preparing a product containing wheat gluten suitable for forming into a chewable pet food and a chewable pet food which overcomes the above-mentioned disadvantages.

### Statements of Invention

**[0006]** According to the invention, there is provided a process for preparing an extrudable product suitable for forming into a chewable pet food the product comprising between 56% to 80% dry wheat gluten mix, between 9% to 28% liquid plasticiser mix and between 8% to 18% moisture by weight of the product, characterised in that; the process comprises;

feeding the dry wheat gluten mix into an extruder having an inlet temperature in the region of between 25°C and 45°C and an exit temperature in the region

of between 50°C and 70°C and mixing the dry wheat gluten mix with water in the extruder to form a moist wheat gluten mix;

heating the liquid plasticiser mix to a temperature in the range of between 40°C and 70°C;

feeding the liquid plasticiser mix into the extruder and mixing with the moist wheat gluten mix in the extruder to form a gluten plasticiser composition; and

extruding the gluten plasticiser composition to form the extrudable product.

**[0007]** The advantage of mixing the dry wheat gluten mix with water prior to addition of the liquid plasticiser mix is that this allows for better control of the moisture content of the extrudable product and resultant pet food. By mixing the water with the dry wheat gluten mix first the desired amount of water can be absorbed by the wheat gluten before addition of the liquid plasticiser mix and none of this water is lost by interacting with the plasticiser. Thus it is sufficient to add the minimum amount

of water necessary to hydrate the wheat gluten mix. Additionally as the wheat gluten mix is moist before it is mixed with the liquid plasticiser mix, a better interaction between the wheat gluten mix and the liquid plasticiser mix occurs. The resultant wheat gluten plasticiser composition is more uniform in consistency, free from lumps and has improved flowability.

**[0008]** Furthermore as it is possible to use less water than heretofore in order to hydrate the dry wheat gluten mix this is advantageous in that it is not necessary to dry the product at any stage to remove excess water which results in both a time and cost saving. Additionally at a lower moisture content, handling and processing of the wheat gluten is improved as the wheat gluten does not stick to the inside of the extruder.

**[0009]** Preferably the extruder has an inlet temperature of the order of 35°C and an exit temperature of the order of 60°C. The advantage of maintaining the extruder temperature below 70°C is to avoid heat denaturation of the protein and in particular the protein content of the wheat gluten, thus avoiding the wheat gluten denaturing and thus allowing the extrudable product containing the wheat gluten to be shaped downstream.

**[0010]** Additionally, by maintaining the temperature below this level, and maintaining a moisture content in the region of between 8% to 18% by weight of the composition. The resultant pet food has a flexible elastic chewy consistency.

**[0011]** Ideally the extruder is run at between 60% and 70% of the operating speed of the extruder. The advantage of running the extruder at this speed, is that due to the low shear rates which result, the temperature does not increase above the desired level in the extruder. Furthermore as less water is required it is possible to run the extruder at this speed. Generally, this will result in an extruder speed of around 370 rpm but will vary depending upon the size of the extruder.

**[0012]** Preferably the dry wheat gluten mix comprises at least 70% wheat gluten by weight of the mix. The advantage of using wheat gluten as a protein source is that as well as being a nutritious ingredient it also has elastic properties and therefore the resultant pet food is chewy. Furthermore, as it is a by-product of many industries such as the milling, brewing and distilling industries, it is a plentiful commodity.

**[0013]** Further preferably the dry wheat gluten mix further comprises a fibre selected from the group consisting of one or more of cellulose fibre, wheat fibre and wheat bran in the range of between 0.1 and 18.0% by weight of the mix. The advantage of adding fibre is that it adds structure to the pet food and has a beneficial role in promoting regularity of the digestive system of the animal. Any source of fibre is suitable.

**[0014]** Ideally the dry wheat gluten mix further comprises chicken digest in the range of between 0.1 and 10.8% by weight of the mix. The advantage of adding chicken digest is to improve the organoleptic properties of the pellet and thus improve the palatability of the resultant pet food.

**[0015]** Preferably the dry wheat gluten mix further comprises monoglycerides of edible fatty acids in the range of between 0.1 and 1.8% by weight of the mix. The advantage of adding monoglycerides of edible fatty acids is that they act as emulsifiers and improve the interaction between the liquid plasticiser mix and water, and between the dry wheat gluten mix and water.

**[0016]** Further, preferably the dry wheat gluten mix comprises a phosphate selected from the group consisting of one or more of sodium tripolyphosphate, calcium tripolyphosphate, calcium hydrogen phosphate and tetrasodium pyrophosphate in the range of between 0.1 and 1.8% by weight of the mix. The advantage of adding a phosphate is that it promotes healthy teeth by acting as a chelate and helping to remove plaque from the teeth of the animal. It also aids in the conversion of the starch fraction of the wheat gluten, and improves the functionality of the starch fraction.

**[0017]** Ideally, the dry wheat gluten mix further comprises a stearate selected from the group consisting of one or more of calcium stearate and magnesium stearate in the range of between 0.1 and 1.8% by weight of the mix. The advantage of adding a stearate is that it acts as an extrusion aid and prevents sticking of the mix to the extruder. Stearates can also be dusted onto the pellets after extrusion. The advantage of this is that sticking of the pellets to each other during storing or handling is prevented. Furthermore, dusting can also prevent the pellets sticking to each other in the initial part of the moulding process.

**[0018]** Preferably the dry wheat gluten mix further comprises potassium chloride in the range of between 0.1 and 0.18% by weight of the mix. The advantage of adding potassium chloride is that it acts as a catalyst, in the conversion of the starch fraction of the wheat gluten by a phosphate such as sodium tripolyphosphate.

**[0019]** Ideally the liquid plasticiser mix comprises at least 95% plasticiser by weight of the liquid plasticiser mix and the plasticiser is selected from the group consisting of one or more of glycerine, propylene glycol, diglycerol, triethylene glycol, urea, sorbitol, mannitol, maltitol, hydrogenated corn syrup, polyvinyl alcohol, polyethylene glycol, $C_{12}$ - $C_{22}$ fatty acids and metal salts of such fatty acids. The advantage of adding a plasticiser such as glycerine is that it improves the processing flowability, acts as a humectant and enhances the flexibility of the resulting pet food.

**[0020]** Preferably the liquid plasticiser mix further comprises a hygiene additive selected from the group consisting of one or more of peppermint oil and parsley oil in the range of between 0.01% and 0.5% by weight of the mix. The advantage of adding hygiene additives such as peppermint oil and parsley oil is that they promote fresh breath.

**[0021]** Further preferably the liquid plasticiser mix further comprises colourings in the range of between 0.01% and 0.5% by weight of the mix. The advantage

of adding colourings is largely for aesthetic purposes. However, preferably chlorophyll is used which has an added benefit in that it occurs naturally in the cells of plant leaves and is not harmful to the animal. Additionally chlorophyll also plays a role in promoting fresh breath of the animal.

**[0022]** In one embodiment of the invention the gluten plasticiser composition is extruded to form pellets. Preferably each pellet has a substantially circular cross-section and a diameter in the region of between 4mm and 8mm. The advantage of the pellets having a diameter in this range is that the pellets are easier to cool and handle.

**[0023]** In a further embodiment of the invention, the processes further comprises;

preheating the pellets in a barrel of an injection moulder to a temperature in the range of between 60°C and 100°C; and

moulding the pellets in a mould of the injection moulder having a temperature in the range of between 115°C and 160°C for between 30 to 80 seconds to form the pet food.

**[0024]** The advantage of injection moulding is that a 3-dimensional shape can be achieved. A further advantage is that the density of the pet food can be increased. The advantage of carrying out injection moulding at an initial temperature in the range of between 60°C to 100°C followed by a temperature in the range of between 115°C to 160°C is that the protein in the wheat gluten only denatures in the last stage of injection moulding. Although protein denaturation can occur at temperatures of the order of 100°C, the pellets are not kept in the barrel for long enough for denaturation to occur. As the liquefied pellets are in the mould at this stage, the protein in the outer skin of the pet food denatures to form a smooth outer skin. The advantage of this is that the pet food retains its shape, has an attractive appearance and is more effective for the animal to chew. Additionally, if the protein only denatures in the outer skin of the pet food, the interior of the pet food has a higher feed value than other products and is therefore more nutritious for the animal.

**[0025]** In another embodiment of the invention the step of extruding the wheat gluten plasticiser composition comprises;

transferring the composition to an elongated die plate in the extruder having a temperature in the region of between 115°C and 160°C; and

retaining the composition in the elongated die plate for at least 5 seconds to form an elongated article.

**[0026]** In a still further embodiment of the invention the process further comprises;

transferring the pellets to an elongated die plate in an extruder having a temperature in the region of between 115°C and 160°C; and

retaining the pellets in the elongated die plate for at least 5 seconds to form an elongated article.

**[0027]** The advantage of preparing an elongated article by extrusion is that this is a faster and cheaper process than injection moulding. Although injection moulding is preferable to produce articles with more complex 3-dimensional shapes and with better finishes, extrusion is the preferable option for less complex shapes.

## Detailed Description of the Invention

**[0028]** The invention will be more clearly understood from the following description of an embodiment thereof, given by way of example only, with reference to the accompanying drawings, in which;

Fig. 1 is an outline drawing showing an extruder according to one embodiment of the invention.

Fig. 2 is a flow diagram of a process according to the invention.

**[0029]** Referring to Fig. 1 there is provided an extruder indicated generally by reference numeral 1 having twin screws 2 and driven by a motor 3. The extruder 1 further comprises an inlet hopper 4 at the extruder inlet 5 and a pair of liquid inlet pipes 6, 7, further downstream. The extruder 1 additionally comprises a conventional pelleting die plate 8, with bores 9 and an associated knife 10.

**[0030]** Essentially the extruder 1 is divided into a mixing zone 11, a cooking zone 12 and a discharge zone 13, interconnected between transfer zones 14, 15, 16 respectively. The mixing and cooking zones 11, 12 comprise paddles for mixing. The paddles in the mixing zone 11 are 30° offset which allows for gentle mixing, and can be either 30°, 60° or 90° offset in the cooking zone 12. A paddle position of 60° or 90° offset would allow more vigorous mixing. Conventional heating means are incorporated within the body of the extruder.

**[0031]** In use the temperature in the extruder 1 increases gradually along the extruder length. Typically, the temperature in the first transfer zone 14, and in the mixing zone 11 is between 25°C and 45°C. The temperature in the second transfer zone 15 is generally between 40°C and 60°C. In the cooking zone 12 and the third transfer zone 16, the temperature is generally between 45°C and 65°C and the temperature is between 50°C and 70°C in the discharge zone 13.

**[0032]** Referring to Fig. 2, there is provided a flow diagram of a process according to the invention. In step 101 a dry wheat gluten mix is prepared and is fed into the extruder 1 through the hopper 4 at the extruder inlet 5, and is transferred along the first transfer zone 14. In step 102 water is fed through the liquid inlet pipe 6. The water is mixed with the dry wheat gluten mix in the mixing zone 11 in step 103 to form a moist wheat gluten mix. In step 104 the moist wheat gluten mix is transferred along the second transfer zone 15 to the cooking zone 12. Liquid platiciser mix is obtained in step 105 and is heated to a temperature in the range of between 40°C to 70°C. In step 106 the heated liquid plasticiser mix is

fed through the liquid inlet pipe 7. The liquid plasticiser mix is mixed with the moist wheat gluten mix in the cooking zone 12 in step 107, to form a gluten plasticiser composition. The liquid plasticiser mix feed rate can be varied to control the extruder torque. In step 108 the gluten plasticiser composition is transferred along the third transfer zone 16 to the discharge zone 13. In the discharge zone 13, the composition can be extruded through a die plate 8 comprising bores 9 and cut by an associated knife 10 into pellets in step 109.

**[0033]** In one embodiment of the invention the pellets are transferred to an injection moulder in step 110 to form a moulded chewable pet food in step 111. The injection moulding process is generally a two stage process. The pellets are fed into the barrel of the injection moulding machine via an agitated hopper or other suitable method. The temperature of the barrel is kept in the range of between 60°C to 100°C. The residence time of the pellets in the barrel should be kept to less than five minutes and preferably in the region of one minute. The pellets are then fed into the mould where they are heated to between 115°C to 160°C and is retained at these temperatures for between 30 to 80 seconds. At this temperature, the protein in the outer section of the pet food denatures to impart a smooth outer layer to the pet food. Optionally the mould cavity of the injection moulding machine is coated with a suitable food grade release coating. The resultant pet food when removed from the mould will retain its shape and harden over time to give an elastic flexible feel which is difficult to break during chewing.

**[0034]** It will be appreciated that the injection moulding process is a time-temperature dependent process, therefore the higher the temperature used the less time is required and vice-versa.

**[0035]** Alternatively in another embodiment of the invention in step 112 the pellets are transferred to a second extruder with an elongated die plate comprising heating means providing a temperature of between 115°C and 160°C. An elongated article is formed in the extruder in step 113.

**[0036]** It will be appreciated that the pellets can be optionally cooled and stored to await further processing. If the pellets are stored, they should be bagged to prevent moisture loss.

**[0037]** In a further embodiment of the invention the die plate 8 comprising bores 9 used in step 109 is replaced with an elongated die plate comprising heating means providing a temperature of between 115°C and 160°C for forming an elongated article in step 114.

**[0038]** In order to form the elongated article of either step 113 or 114, the composition should be retained in the elongated die plate for at least 5 seconds. It will be appreciated that the shape of the elongated die plate will be chosen to have a specific cross-sectional shape which will impart the same cross-sectional shape to the elongated article.

## Example 1

**[0039]** The composition and chewable pet food were prepared as follows and according to the quantities as outlined in Table 1.

**[0040]** A dry mix was prepared by mixing the wheat gluten, cellulose fibre, chicken digest, and calcium stearate together. The dry mix was fed into an extruder having an inlet temperature of 40°C and fed along a transfer zone. Water was then mixed with the dry wheat gluten mix in the mixing zone to provide the moist wheat gluten mix. The paddles in the mixing zone were set at 30° offset. The moist wheat gluten mix was transferred along the second transfer zone of the extruder which had a temperature of 50°C. A liquid platiciser mix was prepared by mixing together the glycerine, peppermint oil and colourings. The liquid plasticiser mix was then heated to a temperature of 55°C before feeding it into the extruder where it was mixed with the moist wheat gluten mix in the cooking zone to form the gluten platiciser composition. The paddles in the cooking zone were set at 60° offset. The temperature in the cooking zone was 55°C. The gluten plasticiser composition was transferred along the third transfer zone having a temperature of 60°C to a discharge zone where the composition was extruded through a die plate and cut into pellets. The pellets were cooled and transferred to a barrel of an injection moulding machine having a temperature of 90°C where the pellets were retained for one minute. The pellets were then transferred to the mould of the injection moulding machine which was at a temperature of 125°C and were retained in the mould for 70 seconds. The pet food was then removed from the mould and allowed to harden.

Table 1 :

| **Composition of Extrudable Product** | |
|---|---|
| **Ingredient** | **Amount %** |
| Wheat gluten | 60 |
| Glycerine | 20 |
| Cellulose fibre | 5 |
| Chicken digest | 2.5 |
| Calcium stearate | 0.5 |
| Peppermint oil | 0.04 |
| Colourings | 0.05 |
| Water | 11.91 |
| **Total** | **100%** |

A high percentage of glycerine was included in this composition and the resultant pet food was found to be very pliable and flexible.

## Example 2

**[0041]** The composition and chewable pet food were prepared as follows and according to the quantities as outlined in Table 2.

**[0042]** A dry mix was prepared by mixing the wheat gluten, cellulose fibre, chicken digest, monoglycerides of edible fatty acids, sodium tripolyphosphate, calcium stearate and potassium chloride together. The dry mix was fed into an extruder having an inlet temperature of 45°C and fed along a transfer zone. Water was then mixed with the dry wheat gluten mix in the mixing zone to provide the moist wheat gluten mix. The paddles in the mixing zone were set at 30° offset. The moist wheat gluten mix was transferred along the second transfer zone of the extruder which had a temperature of 55°C. A liquid plasticiser mix was prepared by mixing together the glycerine, parsley oil and colourings. The liquid plasticiser mix was then heated to a temperature of 55°C before feeding it into the extruder where it was mixed with the moist wheat gluten mix in the cooking zone to form the gluten plasticiser composition.

**[0043]** The paddles in the cooking zone were set at 60° offset. The temperature in the cooking zone was 60°C. The gluten plasticiser composition was transferred along the third transfer zone having a temperature of 65°C to the discharge zone with an elongated die plate, having a temperature of 140°C. The composition was retained in the elongated die plate for 5 seconds until an elongated article having the cross-sectional shape of the die plate was formed. The article was cut to the desired size using the automatic knife and allowed to harden.

Table 2 :

| Composition of Extrudable Product | |
|---|---|
| **Ingredient** | **Amount %** |
| Wheat gluten | 60 |
| Glycerine | 15 |
| Cellulose fibre | 5 |
| Chicken digest | 3 |
| Monoglycerides of edible fatty acids | 0.5 |
| Sodium tripolyphosphate | 0.5 |
| Calcium stearate | 0.5 |
| Potassium chloride | 0.02 |
| Parsley oil | 0.02 |
| Colourings | 0.02 |
| Water | 15.44 |
| **Total** | **100%** |

## Example 3

**[0044]** The composition and chewable pet food were prepared as follows and according to the quantities as outlined in Table 3.

**[0045]** A dry mix was prepared by mixing the wheat gluten, sodium tripolyphosphate and potassium chloride. The dry mix was fed into an extruder having an inlet temperature of 35°C and fed along the transfer zone. Water was then mixed with the dry wheat gluten mix in the mixing zone to provide the moist wheat gluten mix. The paddles in the mixing zone were set at 30° offset. The moist wheat gluten mix was transferred along the second transfer zone of the extruder which had a temperature of 45°C. A liquid plasticiser mix was prepared by mixing together the glycerine, parsley oil and colourings. The liquid plasticiser mix was then heated to a temperature of 50°C before feeding it into the extruder where it was mixed with the moist wheat gluten mix in the cooking zone to form the gluten plasticiser composition. The paddles in the cooking zone were set at 60° offset. The temperature in the cooking zone was 50°C. The gluten plasticiser composition was transferred along the third transfer zone having a temperature of 55°C to a discharge zone where the composition was extruded through a die plate and cut into pellets. The pellets were cooled and transferred to a second extruder with an elongated die plate having a temperature of 130°C. The pellets were retained in the elongated die plate for 5 seconds until an elongated article having the cross-sectional shape of the die plate was formed. The article was cut to the desired size using the automatic knife and allowed to harden

Table 3 :

| Composition of Extrudable Product | |
|---|---|
| **Ingredient** | **Amount %** |
| Wheat gluten | 70 |
| Glycerine | 15 |
| Sodium tripolyphosphate | 1 |
| Potassium chloride | 0.1 |
| Parsley oil | 0.03 |
| Colourings | 0.03 |
| Water | 13.84 |
| **Total** | **100%** |

## Example 4

**[0046]** The composition and chewable pet food were prepared as follows and according to the quantities as outlined in Table 4.

**[0047]** A dry mix was prepared by mixing the wheat gluten, chicken digest and monoglycerides of edible fat-

ty acids together. The dry mix was fed into an extruder having an inlet temperature of 30°C and fed along a transfer zone. Water was then mixed with the dry wheat gluten mix in the mixing zone to provide a moist wheat gluten mix. The paddles in the mixing zone were set at 30° offset. The moist wheat gluten mix was then transferred along the second transfer zone of the extruder which had a temperature of 50°C. A liquid plasticiser mix was prepared by mixing together the glycerine, peppermint oil and colourings. The liquid plasticiser mix was then heated to a temperature of 55°C before feeding it into the extruder where it was mixed with the moist wheat gluten mix in the cooking zone to form a gluten plasticiser composition. The paddles in the cooking zone were set at 60° offset. The temperature in the cooking zone was 55°C. The gluten plasticiser composition was transferred along the third transfer zone having a temperature of 60°C to the discharge zone where the composition was extruded through a die plate and cut into pellets. The pellets were cooled and transferred to a barrel of an injection moulding machine having a temperature of 95°C where the pellets were retained for one minute. The pellets were then transferred to the mould of an injection moulding machine which was at a temperature of 155°C and retained in the mould for 30 seconds. The pet food was then removed from the mould and allowed to harden.

Table 4 :

| Composition of Extrudable Product | |
|---|---|
| **Ingredient** | **Amount %** |
| Wheat gluten | 65 |
| Glycerine | 17 |
| Chicken digest | 3 |
| Monoglycerides of edible fatty acids | 0.5 |
| Peppermint oil | 0.02 |
| Colourings | 0.03 |
| Water | 14.45 |
| **Total** | **100%** |

## Example 5

**[0048]** The composition and chewable pet food were prepared as follows and according to the quantities as outlined in Table 5.

**[0049]** A dry mix was prepared by mixing the wheat gluten, cellulose fibre, sodium tripolyphospate, calcium stearate and potassium chloride together. The dry mix was fed into an extruder having an inlet temperature of 30°C and fed through a transfer zone. Water was then mixed with the dry wheat gluten mix in the mixing zone to provide the moist wheat gluten mix. The paddles in the mixing zone were set at 30° offset. The moist wheat gluten mix was transferred along the second transfer zone of the extruder which had a temperature of 55°C. A liquid plasticiser mix was prepared by mixing together the glycerine and peppermint oil. The liquid plasticiser mix was then heated to a temperature of 60°C before feeding it into the extruder where it was mixed with the moist wheat gluten mix in the cooking zone to form the gluten plasticiser composition. The paddles in the cooking zone were set at 90° offset. The temperature in the cooking zone was 60°C. The wheat gluten plasticiser composition was transferred along the third transfer zone having a temperature of 65°C to a discharge zone where the composition was extruded through a die plate and cut into pellets. The pellets were cooled and transferred to the barrel of an injection moulding machine having a temperature of 90°C where the pellets were retained for one minute. The pellets were then transferred to the mould of the injection moulding machine which was at a temperature of 150°C and were retained in the mould for 45 seconds. The pet food was then removed from the mould and allowed to harden.

Table 5:

| Composition of Extrudable Product | |
|---|---|
| **Ingredient** | **Amount %** |
| Wheat gluten | 65 |
| Glycerine | 10 |
| Cellulose fibre | 7.5 |
| Sodium tripolyphosphate | 0.75 |
| Calcium stearate | 0.5 |
| Potassium chloride | 0.05 |
| Peppermint oil | 0.05 |
| Water | 16.15 |
| **Total** | **100%** |

**[0050]** Table 6 below gives the chemical analysis of a typical extrudable product, prepared by the process of the invention. It will be appreciated that a high source of protein in the product would be the wheat gluten or chicken digest and variations in these components will have an effect on the protein content. Similarly, the fat content is related to the amount of chicken digest added. The wheat gluten and additional fibre are the main sources of fibre in the product.

Table 6:

| Analysis of Extrudable Product | | |
|---|---|---|
| **Component** | **Value (%)** | **Target Range (%)** |
| Protein | 52 | 45-70 |
| Fat | 4 | 0-8 |

Table 6: (continued)

| Analysis of Extrudable Product | | |
|---|---|---|
| **Component** | **Value (%)** | **Target Range (%)** |
| Fibre | 6 | 2-10 |
| Moisture | 15 | 8- 18 |

**[0051]** In the specification the terms "comprise, comprises, comprised and comprising" or any variation thereof and the terms "include, includes, included and including" or any variation thereof are considered to be totally interchangeable and they should all be afforded the widest possible interpretation.

**[0052]** The invention is not limited to the embodiments described above but may be varied within the scope of the claims.

## Claims

1. A process for preparing an extrudable product, suitable for forming into a chewable pet food, the product comprising between 56% to 80% dry wheat gluten mix, between 9% to 28% liquid plasticiser mix and between 8% to 18% moisture by weight of the product, **characterised in that**;

   the process comprises;

   feeding the dry wheat gluten mix into an extruder having an inlet temperature in the region of between 25°C and 45°C and an exit temperature in the region of between 50°C and 70°C and mixing the dry wheat gluten mix with water in the extruder to form a moist wheat gluten mix;

   heating the liquid plasticiser mix to a temperature in the range of between 40°C and 70°C;

   feeding the liquid plasticiser mix into the extruder and mixing with the moist wheat gluten mix in the extruder to form a gluten plasticiser composition; and

   extruding the gluten plasticiser composition to form the extrudable product.

2. A process as claimed in claim 1 wherein the extruder has an inlet temperature of the order of 35°C.

3. A process as claimed in any preceding claim wherein the extruder has an exit temperature of the order of 60°C.

4. A process as claimed in any preceding claim, wherein the extruder is run at between 60% and 70% of the operating speed of the extruder.

5. A process as claimed in any preceding claim, wherein the dry wheat gluten mix comprises at least 70% wheat gluten by weight of the mix.

6. A process as claimed in any preceding claim, wherein the dry wheat gluten mix further comprises a fibre selected from the group consisting of one or more of cellulose fibre, wheat fibre and wheat bran in the range of between 0.1 and 18.0% by weight of the mix.

7. A process as claimed in any preceding claim, wherein the dry wheat gluten mix further comprises chicken digest in the range of between 0.1 and 10.8% by weight of the mix.

8. A process as claimed in any preceding claim, wherein the dry wheat gluten mix further comprises monoglycerides of edible fatty acids in the range of between 0.1 and 1.8% by weight of the mix.

9. A process as claimed in any preceding claim, wherein the dry wheat gluten mix further comprises a phosphate selected from the group consisting of one or more of sodium tripolyphosphate, calcium tripolyphosphate, calcium hydrogen phosphate and tetrasodium pyrophosphate in the range of between 0.1 and 1.8% by weight of the mix.

10. A process as claimed in any preceding claim, wherein the dry wheat gluten mix further comprises a stearate selected from the group consisting of one or more of calcium stearate and magnesium stearate in the range of between 0.1 and 1.8% by weight of the mix.

11. A process as claimed in any preceding claim, wherein the dry wheat gluten mix further comprises potassium chloride in the range of between 0.1 and 0.18% by weight of the mix.

12. A process as claimed in any preceding claim wherein the liquid plasticiser mix comprises at least 95% plasticiser by weight of the liquid plasticiser mix.

13. A process as claimed in claim 12 wherein the plasticiser is selected from the group consisting of one or more of glycerine, propylene glycol, diglycerol, triethylene glycol, urea, sorbitol, mannitol, maltitol, hydrogenated corn syrup, polyvinyl alcohol, polyethylene glycol, $C_{12}$ -$C_{22}$ fatty acids and metal salts of such fatty acids.

14. A process as claimed in any preceding claim, wherein the liquid plasticiser mix further comprises a hygiene additive selected from the group consisting of one or more of peppermint oil and parsley oil in the range of between 0.01% and 0.5% by weight of the mix.

15. A process as claimed in any preceding claim, wherein the liquid plasticiser mix further comprises colourings in the range of between 0.01% and 0.5% by weight of the mix.

16. An extrudable product, suitable for forming into a chewable pet food, prepared by the process as claimed in any preceding claim.

17. A process as claimed in claims 1 to 15, wherein the gluten plasticiser composition is extruded to form pellets.

18. A pellet, suitable for forming into a chewable pet food, prepared by the process as claimed in claim 17.

19. A pellet as claimed in claim 18, which has a substantially circular cross-section and a diameter in the region of between 4mm and 8mm.

20. A process for preparing a moulded chewable pet food from pellets as claimed in claims 18 or 19, the process comprising;

preheating the pellets in a barrel of an injecting moulder to a temperature in the range of between 60°C and 100°C; and

moulding the pellets in a mould of the injection moulder having a temperature in the range of between 115°C and 160°C for between 30 to 80 seconds to form the pet food.

21. A moulded chewable pet food, prepared by the process as claimed in claim 20.

22. A process as claimed in claims 1 to 15 in which the step of extruding the gluten plasticiser composition comprises;

transferring the composition to an elongated die plate in the extruder having a temperature in the region of between 115°C and 160°C; and

retaining the composition in the elongated die plate for at least 5 seconds to form an elongated article.

23. A process as claimed in claim 17, further comprising;

transferring the pellets to an elongated die plate in an extruder having a temperature in the region of between 115°C and 160°C; and

retaining the pellets in the elongated die plate for at least 5 seconds to form an elongated article.

24. An elongated article, prepared by the process as claimed in claims 22 or 23.

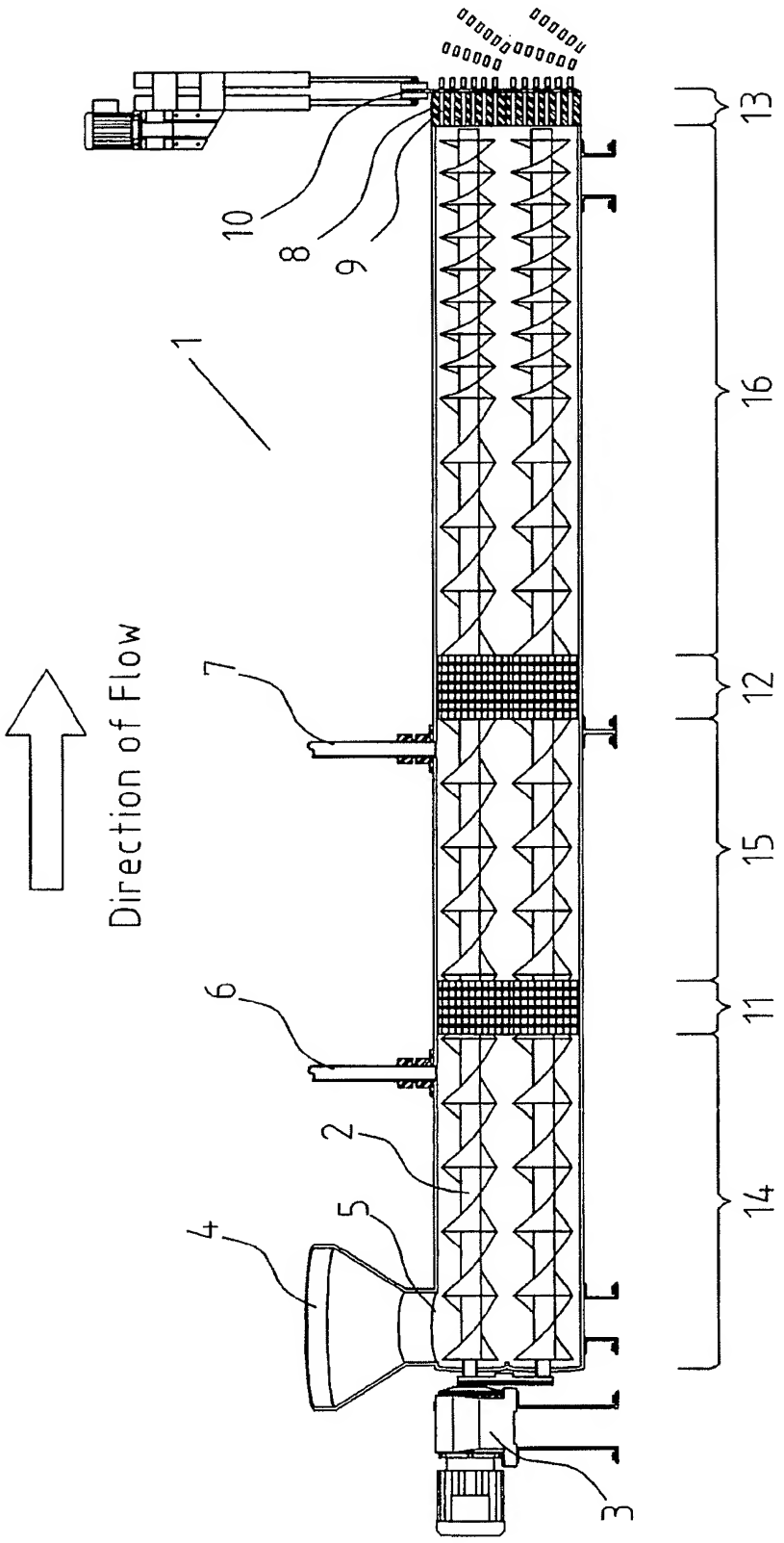


Fig. 1

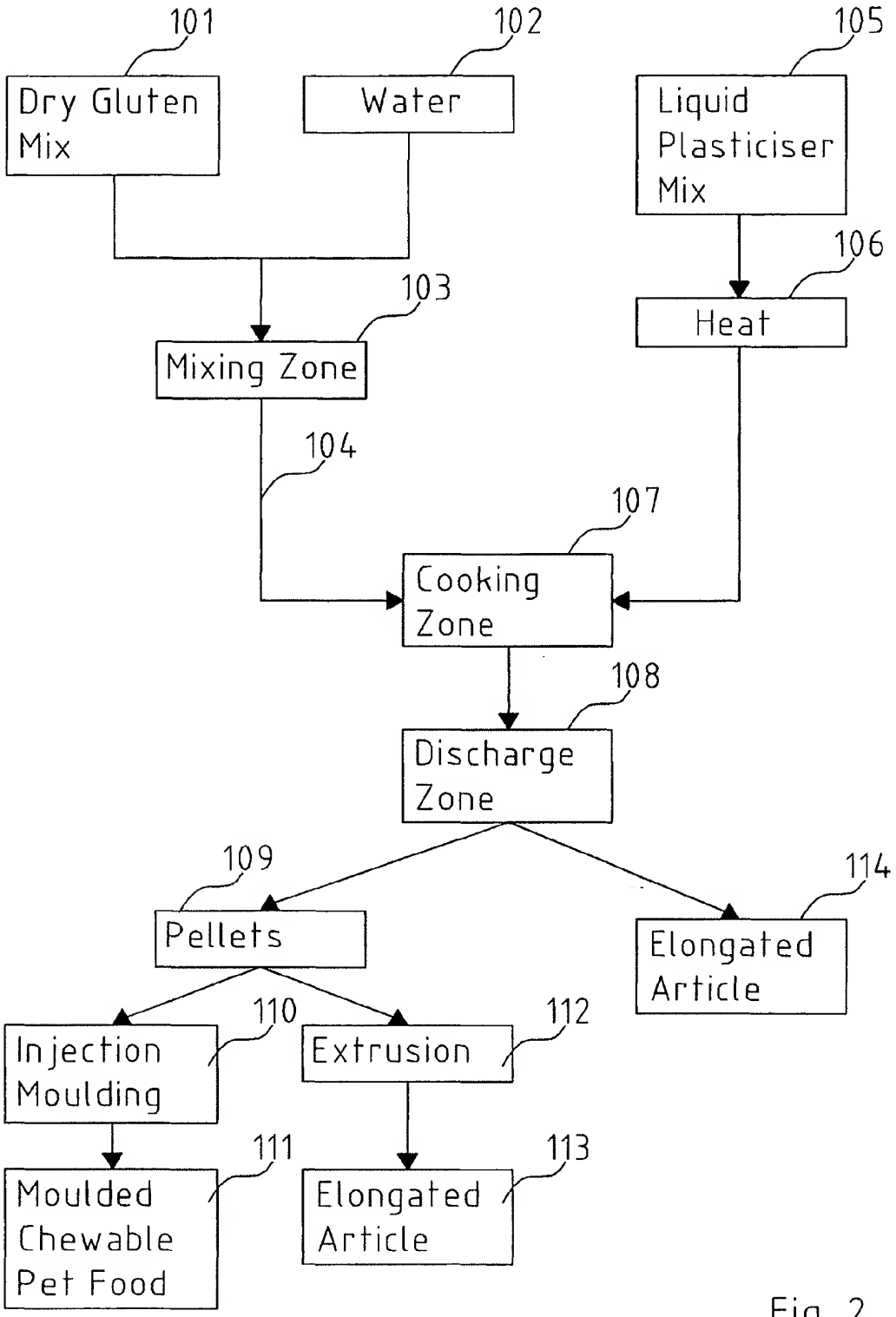
101
Dry Gluten Mix
102
Water
105
Liquid Plasticiser Mix
106
Heat
103
Mixing Zone
104
107
Cooking Zone
108
Discharge Zone
109
Pellets
114
Elongated Article
110
Injection Moulding
112
Extrusion
111
Moulded Chewable Pet Food
113
Elongated Article

Fig. 2

European Patent Office

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Application Number
EP 04 39 4032

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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

A23K
A01K

~~The present search report has been drawn up for all claims~~

| Place of search | Date of completion of the search | Examiner |
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| The Hague | 30 November 2004 | Saunders, T |

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X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

Application Number
EP 04 39 4032

## CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☒ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

## LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

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